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Published in:
EPRINTS-BOOK-TITLE

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Document Version
Publisher's PDF, also known as Version of record

Publication date:
2005

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Kuipers, T. A. F. (2005). Causal composition and structured wholes. Reply to Robert Causey. In EPRINTS-BOOK-TITLE

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Theo A. F. Kuipers

CAUSAL COMPOSITION AND STRUCTURED WHOLE

REPLY TO ROBERT CAUSEY

Robert Causey's contribution reminds me of at least two preliminary points. First, as I also state in the Foreword to SiS, his work, notably his *Unity of Science*, has played an important role in my work, witness in particular Ch. 5, but also Ch. 3 and 6. It is an honor for me that he now presents new ideas in the context of my analysis of reduction of laws and concepts. Second, 'structures' in the title SiS can refer to at least three main uses: the primarily intended meta-sense of patterns in scientific knowledge and knowledge acquisition, the also intended mathematical sense of structures as used to formally represent objects of scientific interest, and finally the ontological-cum-epistemological sense of the nature of certain kinds of objects in the real world, the sense intended by Causey. He develops the notion of a "structured whole" in terms of bonding relations between elements of a (macro-) object (and perhaps its boundary), also simply called bonds, a stable configuration and a theory causally explaining the bonds and the stable configuration. In this way, Causey builds a notion that is at least characteristically, if not fundamentally, presupposed in cases of successful microreduction. In this reply I restrict myself to situating the idealized character of many examples of microreduction and to questioning whether a structured whole is a prerequisite for a genuine reduction.

Causal Composition

Robert Causey is quite right in suggesting that in typical cases of microreduction of a law – the crucial aggregation step together with one or more identification steps – the relevant macro-system or -object is a "structured whole" of one kind or another. As he also rightly notes at the end of his paper, the microreduction of the ideal gas law is an extreme case, since the bonds between the molecules are neglected. The same extreme character holds for my second favorite example of microreduction, that of Olson's quasi-

In: R. Festa, A. Aliseda and J. Peijnenburg (eds.), *Cognitive Structures in Scientific Inquiry (Poznań Studies in the Philosophy of the Sciences and the Humanities, vol. 84)*, pp. 463-465. Amsterdam/New York, NY: Rodopi, 2005.

law about collective goods. Like Causey, I do not see this highly idealized character of paradigmatic examples as a reason to view more realistic putative cases of reduction as completely different in some qualitative sense or as no reduction at all. Instead, as I have shown in detail in the case of Van der Waals (Kuipers 1985), the reductive explanation of a concretized law is itself a concretization of the reductive explanation of the corresponding idealized law. However, in this case the term ‘aggregation’ remains adequate, but in other realistic cases it is not. See, for example, point (1) of my reply to Weber and De Preester.

As I suggest in SiS (p. 87), in cases where more than one type of element is involved, ‘synthesis’ or ‘composition’ can better replace the term ‘aggregation’. The last term or, still more specifically, the term ‘causal composition’ seems particularly adequate to characterize the causal explanation of (some aspect of) the stable configuration characteristic of a structured whole W , that is, an explanation “in terms of the laws of [some theory] T , attributes of the elements of W , and the description of the bonding relations between the elements of W ” (USW5 in Causey’s paper).

Are Structured Wholes Presupposed in Microreduction?

Causey also links his notion of a structured whole to my notion of a “structure representation function” (SiS, Ch. 5). Apart from a minor terminological point, this suggests an interesting question. The minor point is that I wanted to use the term ‘structure representation function’ primarily to refer to the type of values the representation function assigns to certain objects, viz. the function assigns mathematical structures to what I call “macro-objects” or, more generally, “aggregates.” These aggregates correspond to Causey’s structured wholes or they are at least candidates for them, that is, they form the kind of objects that may be qualified as structured wholes.

Now the interesting question is whether being such a structured whole is a necessary condition for a successful microreduction. In Ch. 5 I distinguish between the reduction of laws and concepts, and I distinguish a singular, a multiple and a quasi-form of each. Let us concentrate on the singular forms. Recall that in Causey’s notion of a structured whole the notion of a “stable configuration” which can be causally explained (USW5) is crucial. I certainly believe that obeying a macro-law requires a configuration that is in some sense stable, and hence, if it can be causally explained in terms of bonds between the elements themselves or between the elements and the boundary of the system, the configuration is a structured whole. However, this does not imply that every conceivable (singular) micro-reduction of a law governing an aggregate

requires that this aggregate is a structured whole, for the relevant explanation may be of a different nature. The situation is similar for the case of microreduction of macro-properties, that is, properties of macro-objects. In SiS (p. 138) I claim the following: “Concept reduction only requires concepts at the side to be reduced, which is, of course, supposed to imply that these concepts are relatively stable and intersubjectively applicable.” Hence, it seems that (singular) concept (micro-)reduction already requires a stable configuration. But again this need not imply that the relevant explanation is of the kind required for a structured whole.

For example, although in the case (see Causey’s Section 2) of the balloons that are maintained in a certain configuration, say a sheeplike cloud, only by external forces, the notion of a structured whole does certainly not apply, the sheeplike cloud of balloons is nevertheless the aggregate effect of the external forces operating on the individual balloons, which can hence be microreduced in that sense. To be sure, such aggregates are not very typical, and Causey’s other examples, including those of the “social structure” of robots, are more interesting. I should add that I have no doubt that detailed analysis would show that circuit examples such as the very instructive example of Weber and De Preester, presented in this volume to illustrate the microreduction of laws of artificial systems, and my own favorite example for introducing the idea of (actual and nomic) truth approximation (ICR, Ch. 7), are also typical cases of structured wholes.

REFERENCE

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